

CLAIMS

WHAT IS CLAIMED IS:

1. A method of constructing a data model defined by a plurality of parameters, comprising:
 - collecting a plurality of field measurements, each of said plurality of field measurements bearing an indirect relationship to a first subset of said plurality of parameters;
 - transforming said collected plurality of field measurements into a selected pattern space;
 - determining values for said first subset of said plurality of parameters from said collected plurality of field measurements after transformation, of said collected plurality of field measurements, into said selected pattern space; and
 - constructing said data model using said determined values for said first subset of parameters.
2. The method of claim 1, wherein determining values for said first subset of said plurality of parameters from said collected plurality of field measurements after transformation, of said collected plurality of field measurements, into said selected pattern space further comprises inverting said transformed collected plurality of field measurements.
3. The method of claim 2, wherein said selected pattern space is derived from a trend, in a measurement space, for said collected plurality of field measurements.
4. The method of claim 3, wherein said trend is a pattern vector.
5. The method of claim 1, wherein each of said plurality of field measurements bears a direct relationship to a second subset of said plurality of parameters.
6. The method of claim 5, and further comprising estimating values for said second subset of said plurality of parameters from said collected plurality of field measurements.
7. The method of claim 6, and further comprising constructing said data model using said determined values for said first subset of parameters and said estimated values for said second subset of parameters.
8. The method of claim 7, wherein determining values for said first subset of said plurality of parameters from said collected plurality of field measurements after transformation, of said collected plurality of field measurements, into said selected pattern space further comprises inverting said transformed collected plurality of field measurements.
9. The method of claim 8, wherein said selected pattern space is derived from a trend, in a measurement space, for said collected plurality of field measurements.
10. The method of claim 9, wherein said trend is a pattern vector.

11. The method of claim 10, wherein each one of said plurality of collected measurements is a measurement of conductivity for a subsurface formation and wherein said data model is a conductivity model for said subsurface formation.
12. A method of constructing a data model defined by a plurality of parameters, comprising:
 - collecting a plurality of field measurements, each of said plurality of field measurements bearing an indirect relationship to a first subset of said plurality of parameters and a direct relationship to a second subset of said plurality of parameters;
 - estimating values for said second subset of parameters from said collected plurality of field measurements;
 - transforming said collected plurality of field measurements into a selected pattern space;
 - determining values for said first subset of said plurality of parameters from said collected plurality of field measurements after transformation, of said collected plurality of field measurements, into said selected pattern space;
 - determining, in a measurement space, values for said second subset of said plurality of parameters from said collected plurality of field measurements and said determined values for said first subset of parameters; and
 - constructing said data model using said determined values for said first subset of said plurality of parameters and said determined values for said second subset of said plurality of parameters.
13. The method of claim 12, wherein determining values for said first subset of said plurality of parameters from said collected plurality of field measurements after transformation, of said collected plurality of field measurements, into said selected pattern space further comprises inverting said transformed collected plurality of field measurements.
14. The method of claim 13, wherein said selected pattern space is derived from a trend, in a measurement space, for said collected plurality of field measurements.
15. The method of claim 14, wherein said trend is a pattern vector.
16. The method of claim 13, wherein determining values for said second subset of said plurality of parameters further comprises inverting said collected plurality of field measurements in said measurement space.
17. The method of claim 16, and further comprising iteratively re-determining said first subset of parameters and said second subset of parameters until said first subset of parameters converges on a solution.

18. The method of claim 17, wherein said selected pattern space is derived from a trend, in a measurement space, for said collected plurality of field measurements.
19. The method of claim 18, wherein said trend is a pattern vector.
20. The method of claim 17 wherein said first subset of said plurality of parameters includes a first indirect parameter X and said second subset of said plurality of parameters includes a first direct parameter Y and a second direct parameter Z
21. The method of claim 20, and further comprising iteratively re-determining said first subset of parameters and said second subset of parameters until an object function O_{QPR} converges, within a predetermined threshold value, on a solution for said first indirect parameter X.
22. The method of claim 21, wherein said solution for said first indirect parameter X is located at a minimum point of a plot of said object function O_{QPR} .
23. The method of claim 22, wherein said selected pattern space is derived from a trend, in a measurement space, for said collected plurality of field measurements.
24. The method of claim 23, wherein said trend is a pattern vector.
25. The method of claim 24, wherein collecting a plurality of field measurements further comprises:
 - collecting a plurality of raw measurements; and
 - processing said plurality of raw measurements to correct for possible adverse effects thereon.
26. The method of claim 17, wherein each one of said plurality of collected measurements is a measurement of conductivity for a subsurface formation and wherein said data model is a conductivity model for said subsurface formation.
27. An apparatus for determining at least one characteristic of a subsurface formation, comprising:
 - a logging tool having a transmitter and at least one receiver array, said logging tool acquiring geophysical measurements related to said subsurface geophysical formation; and
 - a computing device coupled to said logging tool, said computing device programmed to:
 - transform said acquired geophysical measurements into a selected pattern space;
 - and
 - calculate, in said pattern space, a subset of indirect parameters for said subsurface formation from said transformed geophysical measurements.

28. The apparatus of claim 27, wherein said computing device is further programmed to calculate, in a measurement space, a subset of direct parameters for said subsurface formation from said geophysical measurements acquired by said logging tool.
29. The apparatus of claim 28, wherein said computing device is further programmed to execute pattern space inversion processing of said acquired geophysical measurements.
30. The apparatus of claim 29, wherein said computing device is further programmed to execute measurement space inversion processing of said acquired geophysical measurements.
31. The apparatus of claim 30, wherein said computing device is further programmed to construct a data model of said subsurface formation from said calculated subset of indirect parameters and said calculated subset of direct parameters.
32. The apparatus of claim 31, wherein said computing device may be further programmed to:
 - re-calculate said subset of indirect parameters for said subsurface formation based upon said calculated subset of direct parameters; and
 - re-calculate said subset of direct parameters based upon said calculated subset of indirect parameters.
33. The apparatus of claim 32, wherein said computing device is further programmed to construct a data model of said subsurface formation from said re-calculated subset of indirect parameters and said re-calculated subset of direct parameters.
34. The apparatus of claim 27, wherein said computing device is locally disposed in said logging tool.
35. The apparatus of claim 27, wherein said computing device is a processor remotely disposed on a surface computer.